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LUMINARY MEMO # 206

TO: Distribution

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SUBJECT: Attitude Error Analysis in Special FACI APS Tests

The difference between the CDUs and the CDUDs can exceed the nominal deadband for the following reasons:

1. The stable member axes are not necessarily parallel to the pilot axes (body pitch, roll, yaw);

2. The nominal DAP control axes (the U, V axes) are 45° from the pilot pitch and roll axes;

3. The actual DAP control axes (the U', V' axes) are displaced from the nominal control axes (on the basis of I_{YY} and I_{ZZ}) up to 15° (viz GSOP subsection 3.4.1)

4. The phase plane attitude error, which is measured in the actual control axes, can be somewhat larger than the deadband due to the limit cycle in powered flight not following the nominal path in the phase plane precisely.

In this hybrid APS test (CDUY - CDUYD) and (CDUZ - CDUZD) are almost exactly equal to pilot pitch and roll errors. The largest values that were observed for these after the ignition transient were -0.6° and -2.5° at time 513441 sec. This corresponds to -2.0° and -1.0° respectively in the U' and V' axes. Considering the magnitude of the bias acceleration about the U' axis, these are perfectly reasonable attitude errors.

Hybrid Run - Period of Interest (1 second intervals)

Attitude Errors-degrees

Error-Q	Error-R	Error-U'	Error-V'
-.2	-1.3	-.9	-.5
-.5	1.9	.8	1.6
-.2	-1.4	-.9	-.6
-.1	2.1	1.2	1.4
-.6	-2.5	-2.0	-1.0
-.3	2.0	1.0	1.5
-.2	-1.3	-.9	-.6
+.2	1.9	1.3	1.0